

SUPPLEMENT.

The Mining Journal, RAILWAY AND COMMERCIAL GAZETTE:

FORMING A COMPLETE RECORD OF THE PROCEEDINGS OF ALL PUBLIC COMPANIES.

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Original Correspondence.

THE COLLIERIES OF NORTH WALES.

The general features connected with the North Wales coal field in Denbighshire and Flintshire may be stated to be the prevalence of seams of magnitude, and minor ones of great number; the working of coal under the sea; the excellence of its Cannel for gas and oil making, and some of its coal for steam purposes, the working of the same being attended with only a small or moderate production of gas. The quantity of coal raised in 1868 is stated to be—

	Tons.	No. of Collieries.
In Denbighshire.....	1,420,000	29
In Flintshire.....	857,500	54
In Anglesey.....	7,500	3

Total..... 2,285,000 66

In addition to the area of the proved portion of this coal field must be added an unproved portion on the eastern side, where the new seams appear at the surface. Unquestionably a large tract of coal will be obtained under the New Red Sandstone. Under the red coal of good quality is now worked by the Ruabon Coal Company, at Hafod-y-bwch, and sinkings are being made towards its development at Wrexham, Bersham, and Kenyon Collieries. The Main coal of Flintshire being identified with the Main coal of the Brymbo and Ruabon districts, and with the Five-yard seam in the Mostyn district. As there are only three seams found below the Main coal the Brymbo collieries, and these not worked, probably further research at increased depth would prove other seams, corresponding number and depth to those at Ruabon.

The ventilation of the coal mines in North Wales is effected by means of furnaces at the surface, in connection with a chimney, at this is where the workings and the production of gas are of but slight extent, and this is considered sufficient for the requirements of the mines. Ordinarily the pits are sunk in pairs, one as a downcast and the other as an upcast pit. The coals in the Wynnastay pits, near Ruabon, produce more gas than any others in the district; the natural produce of fire-damp is great; this, however, is more apparent than real, from the great length to which bratticing is adopted driving out the levels, and for which an improved system of driving out is being substituted. The accident at Ffrwd Colliery, in March last, has brought prominently into notice defective arrangements for ventilation. Safety-lamps were used, but the greatest carelessness was exhibited in using them. After firing a shot, the explosion, the deceased went into his place with a naked light, ignited gas which had been liberated with the fall of coal. The pits, according to the rules, should not be fired except in the presence, or under the direction, of the chartermaster or fireman, and safety lamps only should be used; both of these rules, and many others, having been broken. It is, however, to be expected a better and more careful principle of conducting the ventilation and working of mines will ensue from this enquiry.

The pumping and winding engines erected at the North Wales collieries are nearly uniform in principle, the pumping-engines principally being single or double horizontal engines, with horizontal rods, and T-bobs working to the pit. These being on the second motion, enables a small engine to perform the work of a larger one at increased speed; but there is the disadvantage of more working parts, more friction, and liability to breakage, where these engines often when any strain is put upon them. There are some exceptions to this class—an 80-in. Cornish engine at Rhosddu, a 72-in. at Bronceod Dak pits, and a 52-in. at Brymbo; and a 100-in. Bull engine at Brymbo, at Coed talon a 53 and 30-in. together; besides others on this principle at Hanmer, Leeswood Main, and Plaskynaston collieries. The deep pits at Hafod-y-bwch have no pumping-engine, and those at Wynnastay have only a 12-in. beam-engine to pump the top water. The winding-engines for the most part are double horizontal engines, direct-acting, with flat wire-rope drums, and non-condensing. The form of construction gives great speed and power, and facility in starting the engine at any point, the flat ropes also affording an advantage in starting with the load from the bottom. Vertical engines, with the drums elevated, are almost unknown here, with the exception of one of Wynnastay winding engines, which has double vertical cylinders; there is the advantage of less strain and wear of ropes than in the case of horizontal engines, and in some other very districts this principle, either with a single or double cylinder, is almost generally adhered to. Perhaps the largest engine for raising coal in the kingdom is one at Hafod-y-bwch pits; there are two horizontal cylinders, 6-ft. stroke, direct-acting; two 18-ft. flat-rope drums, non-condensing. It raises six tubs in each cage in three decks; each cage runs on four wire-rope guides. The engine in the upcast pit has two 36-in. horizontal cylinders, raising four tubs in each cage, in two decks, each running on four wire-rope guides. Wire-rope guides are used in North Wales, perhaps, to a greater extent than wood conductors; but the latter, in the case of downcast, are to be preferred, as they admit the use of safety-catches, a more advantage than in the case of wire-rope guides. Desirable it is that safety-catches should be universally adopted, we think that they can be effective and reliable only on wooden rods. The only instances where catches are applied, so far as I have observed, are Owen's catches at Wynnastay downcast, and at Bronwhylfa Colliery, where padlock catches are adapted to wire-rope guides, for a single cage. The teeth of these catches are good they are stated to hold firmly on wire-rope, but they are liable to become worn, owing to the coming into action and gripping the guides every time the cage comes to rest at the top and bottom of the pit; their acting cannot be depended on. We have recently heard of an instance in another district, showing the value of these appliances, at a deep pit where Owen's safety-catches were used with wood conductors. In this cage six coal tubs were raised, in three decks, and four catches were affixed to each, two on each side. One cage with full tubs was raised, and near the top of the pit, when the rope accidentally broke; the catches, however, it is satisfactory to state, immediately came into operation, and the cage descended 2 or 3 in. only. In Lancashire this appliance is largely adopted, and it is hoped North Wales will follow in the use of so desirable an improvement. We can only

refer to two other questions, which now engage public attention, having reference to the safety of coal mines—that is, a better system of inspection, and the employment as managers of mines of men who shall have passed an examination, and obtained a certificate of competency for their duties. Such a provision as the last named would, no doubt, have the effect of throwing out of place a great number, which, perhaps, has prevented any legislative measure on this subject from being brought forward.

The two collieries of Mostyn and Hanmer, adjoining to each other, have their workings under the estuary of the River Dee; in the former only one-half the coal is extracted, the remainder is left as support for the superincumbent strata. In the Hanmer Colliery the coal is understood to be taken away altogether, without leaving any coal as pillars of support. The same seams of coal as worked at Mostyn are bored to at Llanasaph, further west, where they are likely at no distant day to be developed. Large quantities of valuable land have been at different times reclaimed from the sea in this district, by building cohs or dykes to resist the flow of the tides. The effect of further reclamation, which is contemplated, will be to afford increased facilities for working coal under the estuary, and on a more economic principle. The sinking at Bettisfield, near Bagillt, is close to one of these dykes. The pit is now sunk 31 yards, the thick deposit of sea sand at the top has been passed through, also a bed of boulder clay, which is walled or tubbed off so as to exclude the water. At present, the men are sinking through gravel, which gives off water, and an inner case of sinking tubing follows down with the excavation. About 17 yards of water stands in the pit, and the sinking is done by divers, two in the bottom at once. The pneumatic system was tried before this, through the clay, with a tube of cast-iron, 6 feet in diameter, within which the sinkers worked, two at once, in a pressure of 29 lbs. of air. This tube having to be moved to all parts of the pit caused great hindrance to sinking, and is considered the slowest of all the processes that have been tried at this pit. The operation of pumping through running sand has the effect of drawing into the pit an indefinite amount of sand, undermining the surface, and quickly wearing away the buckets and pumps. In the system of sinking with divers the sand remains at rest; and with the pneumatic apparatus there is only a slight action on the sides of the pit, the sand and water being kept back by the superior pressure of air forced down through the tube. In sinking a second pit through the sand it is contemplated to dispense with the tube, and fill the entire pit with compressed air, so as to exclude sand and water, and enable a greater number of sinkers to be employed at the bottom at once; as is done within caissons for building the foundations of bridges.

The iron trade is likely to be further expanded as railways are extended. The Mold and Denbigh Railway will afford an outlet for iron ore now being worked near Nannerch Station; that at Tany-clan is worked by Mr. Darby, and several hundred tons are ready to be sent away to Brymbo. The completion of the railway from Mold to Brymbo will afford direct railway communication from the Mold and Leeswood Collieries to Wrexham. Ironstone is found also at Gledillon, in the neighbourhood of Nannerch. At Llanasaph hematite iron ore is found in several veins of about 3 feet in thickness—should this iron ore be found sufficiently productive, it is in contemplation to erect smelting-furnaces at Mostyn, where the proximity of iron ore, coal, and limestone of good quality for smelting purposes would render it a good position for iron works. Two substantial blast-furnaces at Leeswood, erected at 1836, have been standing three years. The opening out of ironstone mines will give an improved value to this property. As the ironstone was imported principally from distant places during their operation, and there is little associated with the coal measures in the district, the works were carried on to a great disadvantage.

THE VARIOUS MODES OF WORKING COAL.

The recent papers read before the Members of the Midland Institute of Mining Engineers on the various methods of working coal, going over an extensive field, and embracing the views of men eminent in the profession as colliery viewers, contain a great deal of valuable information, and will be read with interest by most persons engaged in mining pursuits. Men like Mr. P. COOPER, Mr. FOWLER, and Mr. EMBLETON speak with an authority that will be generally recognised, bringing, as they do, to the subjects on which they write long practical experience and extensive research, as well as study. Amongst the most important matters in connection with our coal mines is the vast weight of rock, clay, shale, and other strata that lie above the mineral to be worked, and to know what the actual pressure upon a coal seam is at different depths. Mr. FOWLER, in his paper, states—A cubic foot of sand rock weighs 156 lbs.; of shale or bind, 160 lbs.; and of coal, 82 lbs. With regard to the cohesive strength of coal he found, by trial, that the crushing strain of bituminous coal appeared to be 2000 lbs. per square inch. RANKINE gives the crushing strain 1100 to 1700 lbs.; sandstone, 2200 to 5500 to 11,000 lbs. per square inch. Whatever may be the prospects of deep mining, so far as increased temperature is concerned, Mr. FOWLER proceeds to say—"They certainly look somewhat alarming if the crushing strain on coal is reached at 4000 ft. of depth. It is, of course, possible that with certain limits the pressure will compress and solidify the coal."

Mr. COOPER groups the various methods of getting coal into three generic divisions—long wall, bord and pillar, and bank work; but it is admitted that no one system can be applied to mining operations generally, for what mode would be suitable in one colliery would not answer in another, although the same seam was being got in it. Some of the results, however, given of the quantity of coal raised are of a rather interesting character. It is stated, in beds above 40 to 50 in. in thickness, from 80 to 90 per cent. of the entire bed is obtained, of which from 30 to 50 per cent. is small coal; but after screening on the surface the large coal obtained was from 30 to 58·6 per cent., and the slack 70 to 41·4 of the entire bed. In working the Middleton Little coal, 30 in. in thickness, by bords, and 20 yards banks, only 73·3 per cent. of the entire bed is obtained, of which 50 per cent. is stated to be slack, leaving only 23·3 per cent. of the entire bed as obtained by large coal. Mr. FOWLER does not consider that any method of bank work could possibly succeed at a greater depth than 1200 ft., as the proportion of pillars to bank would become so large that pit-room would scarcely be attainable, and from that cause alone would receive the final stroke. With regard to the relative cost and yield per acre of the different methods adopted in

getting coal, the only means of arriving at a satisfactory solution of that important question was by trials in the same seams of coal, where all the conditions were precisely similar, is now generally acknowledged by mining engineers, and was fully recognised by Mr. FOWLER. That gentleman, in noticing an objection sometimes raised against long wall work, that it necessitated a rising face, and that, consequently, the gas in the goaves being light ascends to the face, he considered that such a tendency should be encouraged rather than checked. The difficulty with all goaves was not that they gave off but that they harbored gas. If a goaf were charged with gas, and a heavy fall ensued, it would have to be driven towards the nearest point of exit—the faces. If the goave-roads were so coursed that the goaves were clear of gas an event of that kind could do no injury, as the fact that the gas being light tended to rise assisted in bringing it under the diluent influence of the air-current. It was just the reverse with a face working down hill. There the gas tended towards the goaf, and if a current could not be got through, then it would become foul. In that case, if a fall occurred, the gases contained must be driven out, and then they may prove dangerous. The end of all ventilation being to bring out the gas given off by the mine into the circulating current, under no system of work, Mr. FOWLER gave it as his opinion, could that be more effectually done than in properly applied long wall—a system which resulted in a saving in the expense of working over that of the pillar; the latter being understood as where no pack-walls were built. The following tabular statement of the results obtained in working the long wall system of getting coal at Stafford Main Colliery, in a given quantity of coal, as prepared by Mr. COOPER, on the authority of Mr. MILLER, will give a good idea of the results of the system:—

	SILKSTONE.				PARGATE.			
	With dirt.		Without.		With dirt.		Without.	
Depth from surface	Yards	235	.....	225	.....	135	.....	135
Thickness of bed	Inches	61	.....	61	.....	46	.....	46
Produce per acre:—								
If all got	Tons	8625	.....	7625	.....	7875	.....	5750
Sent to surface	{	6275	.....	6275	.....	5620	.....	5620
Per cent. of the entire bed:—	{	72·75	.....	82·30	.....	71·36	.....	97·70
Produce per cent. of the entire bed:								
Large coal		42·75	.....	52·30	.....	47·36	.....	73·70
Slack, in pit		27·25	.....	17·70	.....	28·64	.....	2·30
" out of pit		30·00	.....	30·00	.....	24·00	.....	24·00
" per cent		87·25	.....	47·70	.....	52·64	.....	26·30

In some of the thin seams, from 40 to 50 inches in thickness, from 80 to 90 per cent. of the entire bed is obtained, of which from 30 per cent. is small coal; but after screening on the surface the large coal obtained is from 30 to 58·6 per cent., and the slack 70 to 41·4 of the entire bed. In working the Middleton Little coal, 30 in. in thickness, by bords, and 20 yards banks, only 73·3 per cent. of the entire bed is obtained, of which 50 per cent. is said to be slack, leaving only 23·3 per cent. of the entire bed as large coal.

It is to be hoped that these interesting and truly practical papers, of which we have given an outline, will be made more generally known than has been the case so far, as they cannot but add materially to the knowledge of the various modes of getting coal which at present prevail in most mining districts, for it seldom occurs that one of such important matters relating to the raising of coal has been so ably handled, and so fully gone into.

THE BATHGATE ACCIDENT—NON-RESPONSIBILITY OF COAL OWNERS.

SIR,—In last week's Journal your Glasgow Correspondent made some remarks in reference to the unfortunate occurrence which took place at the Starlow Shale Pit. If this accident had happened in a coal mine, instead of a shale mine, the relatives of the deceased would have had a good action of damages for compensation—for want of a second outlet; not against the coal owner, but against the manager, and this because the manager was a competent man, and it was his fault that there was no second outlet, and the law holds that if a coal owner has appointed a competent manager to superintend his works he has done all he can do. Now, if the manager had been worth a few thousand pounds he could have been mulcted of it, while the owner would have escaped scot free.

Indeed, unless the owner is the manager, the Act does not get at him for breach of any of the General Rules. This is not, I think, what the Legislature intended, but there can be no doubt it is the fact, and the words owner or agent need not be in the Bill at all. It is well that this should be clearly understood while Parliament is legislating on the subject.—April 19. A COAL MASTER.

THE REMARKABLE DISTRIBUTION AND VAST EXTENT OF THE COAL FIELDS OF BRITISH AMERICA, THEIR GREAT IMPORTANCE TO THE EMPIRE—900,000 SQUARE MILES IN THE CENTRE—18,000 SQUARE MILES ON THE ATLANTIC COAST—ABOUT 10,000 SQUARE MILES ON THE PACIFIC COAST.

SIR,—Great Britain owns over 2,500,000 square miles of land on the North American continent: 425,000 square miles of which constitute the Dominion of Canada—being less than one-fifth of the whole, and not more than one-fourth of even that can be regarded as occupied land—leaving 2,400,000 square miles still unoccupied.

The total area of Great Britain and Ireland is a little less than 123,000 square miles, with a population of about 400 persons to the square mile, while in British America we scarcely number three persons to the square mile, including the Indians. But the country is capable of sustaining at least 200 persons to the square mile—equal to a population for the whole of 250,000,000—and its natural resources are capable of sustaining this number during an indefinite period of time.

To Great Britain coal is regarded as one of the most essential elements of prosperity and power, because a very large proportion of her population is engaged in commercial and manufacturing pursuits whose existence depends on coal. Although her soil is capable of sustaining a comparatively large and prosperous population, and though its fertility is capable of endless renewal, yet she cannot retain her status in the world as a first-class power for a much longer period of time than her supply of coal lasts. At the present rapidly increasing rate of consumption her own supply within the British Isles cannot last much over 250 or 300 years—a very small point in the life-time of a nation.

It is quite clear, therefore, that the time must soon come when she will be dependent for her very existence, as a first-class power, on her great possessions on the North American continent. The quan-

ity of coal yet known in all other parts of the world is so limited in extent as to be utterly insufficient to supply the greatly increased demand at that distant period of time. With the exception of British America, the United States is the only country in the world that can be said to possess within its own territory an inexhaustible supply of coal. But it would never do for Great Britain to depend on another nation for her supply of an element essential to her existence as a first-class power. British statesmen should, therefore, see that ample provision is now made to secure an inexhaustible supply of coal to meet the future wants of the nation. To secure this very desirable end, British America must be regarded as of vital importance to the empire, with which it should be firmly incorporated by some means as soon as possible. Every necessary sacrifice should be made to secure the accomplishment of this object while it is possible, for the future prosperity and greatness of the empire depends on it to a larger extent than is generally supposed. The extent of land underlain by coal in the British Isles is supposed to be about 12,000 square miles. A large extent of that area has already been worked out where the coal was most accessible, so that it may be regarded as quite certain that the price of coal must advance greatly, even during the next 50 years, on account of increased cost of mining. The coal consumers of Great Britain will thus be taught by degrees to look to America for their supply of coal; but should America, in the meantime, all pass under the control of foreign nation, Great Britain will have lost some of the finest coal fields in the world, over 20,000 square miles in extent of which are lying in the neighbourhood of good harbours, both on the Atlantic and Pacific coasts, where her ships can reach it at all seasons of the year. This could not fail to prove a tremendous loss to a nation like Great Britain, depending so much for defence on her steam navy.

The United States have control already over no less than 600,000 square miles of coal; enough to last as long, in all probability, as steam-power will be required for national defence, or as a means of securing national supremacy. The coal fields of British North America surpass, in extent and value, those of all other countries in the world put together, and contain a quantity of coal sufficient to supply the wants of the nation and secure its supremacy down to the latest periods of time. Should British statesmen, however, be now so short-sighted and blind to the true interest of the empire as to allow those vast areas of coal land to pass beyond their control, they will have committed a great mistake, and blasted the future prospects of the empire beyond remedy.

Perhaps a fearful mistake has already been committed in this matter when the Dominion of Canada was established, for it will, in all probability, ask for its independence in a few years, and may ultimately prove as selfish as any other foreign power, and give cause for regret that the country was not then made an integral part of the empire, so that the nation might have ample room for indefinite expansion within its own territories. The old British oak would thus be enabled to extend some of its roots deeply and firmly into a soil in which the Creator stored an inexhaustible supply of elements necessary for sustaining the vigour of perpetual youth. The short-sighted policy of lopping off the branches and planting them in the very soil into which the roots of the old tree should have been extended must ultimately lead to its decay as an old sapless stump, surrounded by a selfish and ungrateful offspring. This suicidal policy should be at once abandoned, and the power of the empire should be firmly established on this continent by absolute incorporation by the transfer of the redundant home population, and the employment of sufficient capital to assist in the speedy development of its vast resources.

The most vital interests of the nation demand an immediate investigation of the whole subject, particularly the future relations of the empire and its North American provinces. It is also very desirable that the vast unoccupied regions in the interior of the continent should be carefully explored. Regarding the great extent of the region, where the soil and climate are of a very favourable character, much has already been made known, but much more is yet required before emigration on a large scale can be induced to enter the country.

Regarding the mineral wealth of the interior regions very little is known beyond what private adventure has brought to light, and a few important facts made known by scientific men attached to the various expeditions sent from time to time to the Arctic Sea, and across the Rocky Mountains within British territory. But even in these scanty materials, when carefully examined in connection with many facts brought to light by recent geological explorations in the Western States, we find sufficient evidence to warrant the conclusion that the country abounds in mineral wealth of every description to an extraordinary degree.

It has been well known for a long time that skirting the eastern base of the Rocky Mountains, from Mexico to the shores of the Arctic Ocean, for a distance over 2500 miles, the country is occupied by Permian, Cretaceous, and Tertiary deposits, containing valuable beds of brown coal or lignite.

The average breadth of the trough occupied by the Permian, Cretaceous, and Tertiary groups of strata is supposed to be about 500 miles, covering an area of 1,250,000 square miles; 900,000 square miles of this lie north of the 49th degree of north latitude, or in British territory.

Having carefully examined all the facts brought to light in connection with the subject, I find abundant evidence to prove beyond all doubt that true coal measures of the carboniferous group underlie the newer deposits over the whole of this vast area. Within the United States their outcrops have been discovered at various points on each side of the trough, and they are found to contain valuable beds of true bituminous coal of excellent quality, and of workable thickness ranging from 2 to 6 feet. Those found on the eastern edge of the trough dip at an angle of 4 or 5 ft. to the mile; while those exposed on the western edge are found dipping at a steep angle in the opposite direction, or eastward, after passing nearly 700 miles beneath Permian, Cretaceous, and Tertiary strata.

At the 49th parallel, or boundary line, this great coal field cannot be much short of 600 miles in breadth from east to west. This would give over 450,000 square miles in that portion of it lying between the 49th and 59th parallels of north latitude, where those vast plains occur that are so well adapted for agricultural purposes. Between the 59 parallel and the North Sea there cannot be much less than 500,000 square miles that are underlain by true coal measures, making in all the enormous area of 950,000 square miles of land underlain by coal in one unbroken field.

This vast coal field is bounded on its western edge by the most easterly range of the Rocky Mountains; and it is probable that several detached basins of coal exist between the mountain ranges, in some of which anthracite will probably be found. Eastwardly it is bounded by a belt of metamorphic rocks, that extends from the Arctic Sea to the north shore of Lake Superior, on a course nearly parallel with the Rocky Mountains, for a distance of 1800 miles. The average breadth of this belt is about 200 miles; it is not much elevated above the country east and west of it occupied by the newer formations. It is known to contain rich deposits of iron ore, and will probably be found to contain gold also, for the rocks are of the same age as the gold-bearing rocks of Nova Scotia.

From the west end of Lake Athabasca, or about lat. 53° north, and long. 112° west, to the 49th parallel, between 97° and 98° west long., a point near Pembina, the belt occupied by the outcrops of the true coal measures may be traced for a distance of 900 miles. It passes a short distance west of Buffalo Lake, La Crosse Lake, Pine Island Lake, and close to the west shore of Winnipegosis Lake and Manitoulin Lake, and thence nearly through the middle of the States Minnesota and Iowa to Boonsville on the Missouri River, where the strata of the groups are well exposed in its banks.

It is impossible now to appreciate fully the value of this vast store of mineral fuel, placed by the Creator beneath those fertile, but almost treeless, plains that form so large a portion of the interior of this great continent. It was evidently designed that the nations possessing it should be prosperous, powerful, and durable; for in no other part of the world has provision been made for such a purpose on so vast a scale. And we may rest assured that it was not made here in vain,—no! not even that portion of it lying within the Arctic regions.

Now is the proper time for securing to the British empire the in-

calculable advantages that must result in the future from the possession of this vast store of an element so essential to national prosperity and greatness. Let its possession, therefore, be made secure now, and many centuries will not pass until the very centre of British imperial power is found established firmly on her own portion of the American continent. From this central position, with inexhaustible supplies at her command, she can continue to hold the highest place among the nations down to the close of time,—should the vast resources of the country be developed, and no other causes operate to bring about the decline of her prosperity and power.

The firm establishment of British imperial power on this continent cannot fail to result in great good also to the powerful nation that now occupies the southern portion of it. The friendly rivalry that would be thus ensured between the two great sections of the same family, as to who should best work and best agree, would secure mutual and permanent benefits of incalculable value to themselves and to the whole world. A friendly struggle for supremacy between the two great Christian and highly civilised nations, having the natural advantages about equal on both sides, would be conservative in its effects on their laws and institutions, and would greatly tend to remove much that is evil and corrupt in their rival systems of civil government. Mutual understanding and goodwill would thus be promoted, and the two nations would make such rapid progress, and would attain to such great power and influence in the world as to enable them to put an end for ever to national wars, and render great standing armies unnecessary in civilised countries.

Dartmouth, N.S., April 4. — JOHN CAMPBELL.

TIN IN CALIFORNIA.

SIR,—In the Journal of April 9, under the heading "Tin in America," reference was made to the discovery of tin mines in California, which it is said had been officially pronounced as the richest in the world. As this announcement must have excited the curiosity of many interested persons, I have thought the following letter, which I presume is the "official" document alluded to, would be deemed of sufficient importance for publication in the *Mining Journal*. The writer is a well-known American authority on metallurgical matters—Dr. A. R. Roessler, the learned and efficient mineralogist of the United States General Land Office.—*Albemarle-street, April 20.* U. S.

It will be remembered that an Exposition of the agricultural, manufacturing and mineral resources of California was held last year at San Francisco, at which were exhibited the unmistakable evidence of the existence of the metal tin in California. Sacks of ore, bars of tin-plate of the heaviest quality, and utensils of every sort for domestic use, which were manufactured from it, were there collected. There were many who doubted, and shook their heads at this display of a long-desired but unusual manifestation of riches. The days of humbug were not yet over. Gold and silver, quicksilver and platinum, and many other more common metals, in any quantity, they should believe in, but tin, so valuable, and found in so few localities in the world, was a demand on their credulity not to be honoured. This uncertainty has become not a dead but a living certainty. Additional information and additional specimens of ores have been forwarded to this office, and an average sample of the same has been submitted for analysis to the able and distinguished chemist and mineralogist, Dr. F. A. Genth, who reports that it contains 13.37 per cent. of tin. The black mineral in the ore is tourmaline (it contains boric acid), and the brownish-red is the casiterite. It is a highly interesting occurrence, and the yield of tin is almost twice as much as the usual working ores of the tin mines of Cornwall, England. The property is said to consist of 50,000 acres of mining lands, and over 20 openings have been effected, from all of which the ore is extracted. The finding of this important metal in California may be regarded as the last crowning act which was required to place California in advance of all the world for mineral wealth.

RHENISH PRUSSIA—No. IX.

SIR,—That success must attend Prussian mining fairly carried out is a certainty, and it is gratifying to find the *Phönix* Mine is in the hands of English capitalists. The constitution of the board, backed by the reports of Capt. St. Richards, Capt. T. Rickard, and the cautious, but always safe, Capt. Thos. Trevellian, warrant more than all the statements made in the prospectus. The course taken of obtaining such a strong private list of subscribers as ensured success is in every way judicious and sound.

Clementslust and St. Josephsberg shareholders may well take courage from the fact that at Alderley Edge Mine, in Cheshire, where the average quality of the ore does not exceed one and a half per cent. produce, the company availing itself of the acid process used at the Clementslust and St. Josephsberg Mines, has returned all its capital, and is now making large profits, and this, after paying 10s. per ton for the carriage of the acid, as against less than one shilling in Prussia, whilst the scrap iron is also much cheaper there, and the ores far more soluble than in England, at the same time that the average produce of the low quality phosphate, carbonate, and malachite ores in Clementslust is four to six per cent., as against one and a half in Alderley Edge, the Clementslust leaders being three in number, and from one to four feet wide, of a produce of twenty to thirty-five or forty per cent.; this being, of course, the primary source of profit, the low quality only an assistant, whilst the low quality ores alone are the entire source of produce in Alderley Edge; and it is never to be forgotten that the dues are one-fiftieth in Prussia, as against (say) one-sixteenth in England. Absence and the holidays are my excuse for this short communication.

Bonn, April 21.

OUR CORRESPONDENT.

METALLIC MINING—No. II.

SIR,—In order to ensure the permanency of the present interest with which metallic mining is regarded by capitalists, it is absolutely necessary that reform in the management of the mine should be, where required, at once inaugurated, so that when the somewhat artificial stimulus of extraordinary success, as illustrated by the Welsh prizes, dies away all who have been allured to metallic mining from exceptional cases may be retained by being recompensed with returns which if not akin to these may at least be of such a present or prospective character as make it preferable to other investments.

Whether we recognise the fact or not, there exists a pretty general aversion to metallic miners and mining amongst the moneyed class, founded, no doubt, in a general way on an ignorant prejudice that cannot give or has no reason, but in others to tangible causes, in the shape of heavy actual loss, that admits of no dispute. Losses will, and do often, occur in every undertaking, and the sufferers generally accept the result with an equanimity that seldom parades itself in public, but it is usually otherwise when the loss is met with in mining adventure, and doubtless the vague feeling as to the untrustworthy character of metallic mining as an investment which pervades society owes its existence and sustenance to cases of this kind, which being felt doubly severe, owing to the aggravated circumstances of assured positive gain that unprincipled persons amuse their victims with up to the final denouement of liquidation, reacts with fatal force on mining enterprise, involving legitimate concerns, and all connected therewith, in a sweeping condemnation, that although most unjust, nevertheless from the heartless surroundings of the widely-circulated case, too often experienced as above, enacts a rude retributive justice, which, if we would avoid the baneful effect of its repetition, will make us watchful to keep within the strict bounds of truth in all mining reports, and make the fulfilment of promises more an object to be religiously aimed at than, as too often occurs where these are used profusely, to secure some selfish end merely.

The hurtful influence caused by the holding out of hopes that when advanced are known to be fallacious is at the present time unquestionably a serious hindrance to mining attaining that prominence and regard with the general public which its otherwise pre-eminent claims deserve. Managers should, therefore, be particularly careful in their public reports as to the value of the different workings in the mines under their charge, for there is no doubt but that an interest in these is often secured solely on the faith of the details of progress, as consecutively reported in the *Journal*; and, relying on the good faith of these statements, such investors especially evince a disposition when the general meeting comes round to exact their pound of flesh, and armed, as they often are, with the agent's own estimates, and an array of figures founded thereon, it often places sanguine or careless agents in an awkward position when a different result is realised than that confidently predicted. When this occurs it invariably lays the foundation of a distrust that, while detrimental to the success of the particular undertaking, is indirectly hurtful to mining everywhere, and also damaging to the agent's reputation and future usefulness, and often a cause of annoyance to the directorate, who are sensitively alive, or ought to be, to the moral and commercial stigma that attaches to culpable exaggeration.

While recognising the necessity—and, in fact, thoroughly in accord

with the practice that is now so frequent—of calling in skilled mining engineers to advise with and aid the resident agent in arriving at the best plan to utilise present advantages, and report as to the future of the undertaking, I do not think it is commendable to encourage a system, now rather frequent, of pledging the inspector's credit, to the stock of ore on hand. I do not at all doubt the ability and integrity of these gentlemen, and I do not question either when I say that it is impossible for any stranger, however skilful, to form an estimate of the ore broken in an extensive mine by a cursory visit of a few hours. In some mines the ore is so varied and peculiar that experience alone can distinguish between the mineral and its seemingly-like gangue; and, besides, it must be remembered that the ore stuff is stored in such a variety of ways—in hoppers and other inaccessible places—that nothing short of miraculous endowment could form any idea whatever of the value contained therein; and, as the inspector has thus to depend wholly on the statements of the manager as to the greater part of the quantity and quality broken in most mines, it is as well that shareholders not conversant with mining should know the fact, and accept their own agent's valuation, since he is best able to give a reliable estimate. No doubt in most cases where this corroboration is used it flows from a laudable desire to give every assurance that the resources are as stated; but it is a questionable procedure, founded, as it often is, on a mistaken notion, that may eventually peril the credibility of the endorsee by inducing a false security, from which a rude awakening may arise.

Adventurers are, and must always be, in a great measure, dependent on their agent for the possession and due use of the essentials necessary to the successful working of their property; and I conceive that truthfulness is not the least of the requirements which are indispensable at the present time; it cannot, therefore, be too often reiterated that real progress must be based on truth, and on no other foundation can a lasting prosperity be secured in any pursuit; least of all, in metallic mining, where confidence must go hand-in-hand with the patience and perseverance that are frequently necessary ere success crowns the enterprise.—*Calbeck, April 20.* W. GIBSON.

FESTINOG SLATE QUARRIES AND RAILWAY.

SIR,—In the Supplement to the *Journal* of April 9 you had a well-written article on the above subject, into which an error or two of some magnitude had crept, which, with your permission, I shall endeavour to rectify. In the article alluded to it was said that the number of persons employed at the Welsh Slate Company's Quarry is 300, and that the monthly make of slates is about 3500 tons. The former figure is not correct, and the latter would have been nearer the mark had it been 4000 tons. I would not have noticed this slight error, for such it is in one sense, only that the English folks are so fond of working out the most plausible calculations when once they get data to start with, and such data as these two items afford. This is the point I wish to draw your attention to—the proportion between the number of men employed and the monthly make of slates, or, in another shape, the proportion between the cost and the value per ton. The value per ton of slates at the Welsh Slate Company's Quarry would, I should say, be about 27. 17s. 6d.—therefore the value of 3500 tons would amount, in round numbers, to 10,000.

Suppose, again, you allow 4s. 2d. per diem, on an average, to each workman, the amount of payment, therefore, in this case for a month would be about 1500£, consequently the cost would only amount to about 8s. 6d. per ton, and the very idea of the thing would make many an old speculator in slate quarries crazy, and to wonder what sort of being Mr. Robert Owen, the much-respected agent of the quarry, could be; he would surely think him not an unworthy object of being exhibited at the British Museum. Add, again, to the 1500£, another 1000£, which item would include royalty, haulage, wharf expenses, &c., and you would have a net profit of 7500£ in one month, or at the rate of 90,000£ clear profit annually.

The next point the writer errs in is—the width of the vein. According to his statement it is only 50 ft.; he should have said 50 yards, for were you to measure horizontally across the main vein on the upper floor of the Welsh Slate Company's Quarry, and the lower floor of Messrs. Matthews and Sons' Quarry, six floors from the surface, you would find the width to be about 72 yards. Now, 72 yards being the hypotenuse, lying at an angle of 45°, will give a base of about 51 yards, the width of the main vein at that spot. Of course, the main vein is not uniformly of this width; it varies greatly at different places along the length of the vein. This subject is interesting, and would itself exhaust a good article.

Festiniog, April 16.

AN OBSERVER.

MINING IN FLINTSHIRE—No. II.

GREAT HENDRE AND RHOSMOR AMALGAMATION.

SIR,—The GREAT HENDRE was started about four years ago, with a capital of 40,000£, under the most encouraging prospects, from the fact of the mine within the former working having yielded upwards of 27,530 tons of ore, and paid in dividends over 119,000£. It was abandoned for want of sufficient pumping-power to sink the mine to a deeper level, and, it is said, on application being made to the Lord for a reduction of dues it was positively refused. The new company provided ample pumping and winding power for all purposes, including three pumping engines—one 100-in. cylinder, one 70-in., and one, I believe, 30-in.—with pit-work varying in size from 30 in. poles to 9 in., and drawing-lifts, which proved to be quite sufficient to drain and fully develop the mine at deeper levels. But, unfortunately, as in nine cases out of ten, at the time these erections had been completed, and the water drained to the bottom, so that a formal inspection could be made by the inspectors wading above the knee in water, it was found that a great deal more than the capital called-up was being expended, and there was no alternative but to wind-up the company through liquidation, without extracting a single yard of the lode, or drawing a single bucket of accumulated stuff from either level in the mine. Thus, the original reports stand equally good to the general prospects of the mine, and far better as to machinery.

The RHOSMOR MINE is situated about one mile east of the Hendre Mine, and, no doubt, contains some of the same lodes. One only has been worked on to any great extent, which has yielded about 100,000£ worth of ore, and returned in dividends upwards of 30,000£ above the level of the water in the Hendre Mine, which at that date was idle. The prospects of the mine justified the company in erecting a 70-in. cylinder engine, which being done the development of the mine was continued successfully for some time. In fact, up to the date of the re-working of the Hendre Mine, when it was considerably relieved; so much so, indeed, as to enter into an agreement with the Hendre Company to pay them 60£ per month as water-charge; but, unfortunately, the Hendre Mine soon stopped, and naturally the bulk of the water again came to the Rhosmor engines, and the agreement as to the water-charge ended in an expensive lawsuit. Notwithstanding these adverse circumstances, the prospects at the Rhosmor were such as to encourage the company to sink a new shaft, and fix a new 90-in. cylinder engine, in addition to the 70-in. one. Estimates were given, and the capital subscribed accordingly; but, as it often occurs in such cases, when the work was finished the company found they were some thousands of pounds in debt over the estimated capital, and, as their neighbors had no alternative but to wind-up through liquidation; therefore, the prospects are just the same as when the company resolved on applying the extra pumping power, the engine-shaft only being sunk a few yards below the water-level.

From the facts as stated above, the position and prospects of these two great and valuable mines can be easily seen, and any observing mind can readily understand the great necessity for an amalgamation to ensure a perfect success. The two mines being supplied with abundant machinery at surface, and pit-work direct at each engine-shaft to the bottom, it only remains to call up (say) 30,000£ to prosecute them in depth and length, when success will be certain, and, no doubt, another Minera added to the Principality. I trust the two companies will see the necessity of doing so, as I know they are well able.

I might add that a new company is being formed for Rhosmor. Their debts are all paid, and the works resumed, without a public announcement.

P.S.—The North Hendre has greatly improved this week.

ANGUS.

EAST WHEAL LOVELL.

SIR,—In the Supplement to last week's *Journal* are two letters, both written with the evident design of depressing the market value of the shares in this mine. As a bona fide investor in East Lovell, and knowing the mine to be perfectly sound and honestly managed, allow me to say that I think it most unbecomingly in an anonymous writer to send letters to the *Journal* for the purpose of injuring the property. I beg leave to enquire whether "Another Observer" and "A Disinterested Observer" hold any shares in this mine? If so, they are most unwise thus to disparage their own property. If they are not shareholders what object have they in trying to depreciate the mine? Perhaps they are "philanthropists," and write for the purpose of benefiting their fellow-men. I have to request these gentlemen to publish their names and addresses in the *Journal*, that I may know something about them. They are trying to injure the property, I want to know who they are? As to Capt. Quantrell, he is perfectly justified in endeavouring to counteract the machinations of speculators who are trying to injure the property of his employers.

It is not so long since that one of these gentry, by making false reports on the West Chiverton Mine, succeeded in "bearing" the shares down to 4s. each, the original price being 60s. On that occasion you will recollect I wrote to the *Journal*, and exposed the whole transaction.

"A Disinterested Observer" says that "mine captains should confine their reports to the mines, and leave the market to market-men"—that means to say, reports to the mines, and leave the market to live by spreading unfounded reports and gambling in shares they have paid for, pocketing the difference on the settling-day. In conclusion, I will only add that I gave 26s. each of my

time. In conclusion, I have only to say that the sett is in every respect worthy of a spirited working, and I conscientiously believe that judicious and energetic management will result in the establishment of a great and lasting property, second to none in the neighbourhood.—HENRY G. WILLIAMS.

[For remainder of Original Correspondence, see this day's Journal.]

ing lodes would have to put up their shutters. Undoubtedly the copper trade will get much worse than it is even at present, and of a necessity the bulk of the

MINING IN AUSTRALASIA—MONTHLY SUMMARY.

BRENTON.—Owing to the inefficiency of the steam-engine to keep the coming water in the bottom of the shaft, and there not being what I con-

VICTORIA, Feb. 28.—The news from the gold fields is very encouraging. A nugget weighing over 116 ozs., found in the Perseverance claim, Pitfield plains, near Smythesdale. A party at Berlin also recently unearthed two nuggets weighing 24 ozs. and 6 ozs. 13 dwts., and during the same week others of 7 ozs. and 6 ozs. 6 dwts. respectively. In Catto's Paddock three nuggets were turned up weighing 260 ozs., 117 ozs., and 9 ozs. The Bank of New South Wales purchased from a party working in the last-named claim a nugget of 116 ozs. 13 dwts. 12 grs., valued at £1,000. Tyler's claim, near Berlin, has 65 ozs. was got, and numerous other finds are mentioned. Some of the alluvial claims on Crooked River yield richly. In several the shareholders are netting over 10l. per week each. Gold shipments during the month, 101,601 ozs.

SYDNEY, Feb. 25.—The news from the gold fields is unimportant. Fine specimens of ore found in a recently-discovered lead and silver mine at Girinderra : 378 diamonds go forward by the mail steamer this month on account of the small quantity of diamonds being brought to the market. These reports sent the yield of the past four weeks, the most important yet obtained. A parcel of small rubies is sent by the same mail to test the London market; 184 diamonds have also been forwarded to Melbourne from the Cudgunge River. The aggregate gold receipts per Government escorts during 1869 exhibit a decrease, as compared with the previous year, the weight being, for 1868, 222,738 ozs., and for last year, 214,387 ozs.

ADELAIDE, Mich 1.—Very rich specimens of gold-bearing quartz have been obtained from the vicinity of Blumberg. A company has been formed to develop the property, gold found in the reef running through the section. At Barossa gold has been discovered in the lead, which inspires confidence in the permanency of the field. A regulation has been passed for the issue of gold licences to the end of June on payment of £d.: 80007. worth of gold exhibited at the Royal Agricultural Show, the produce of the colony, by the English, Scottish, and Australian Chartered Bank.

BRISBANE, Feb. 26.—A patch of gold has been struck at Gympie, in Bristol reef; rich specimens taken out; 19 tons of stone from No. 1 Californian reef yielded 585 ozs. of gold. Total export for month ending Dec. 31, 27,459 ozs.

AUCKLAND.—The yield from the Thames and Coromandel continues equal to last year's average. —

AUSTRALIAN MINES.

YUDANAMUTAA.—The directors have received advices from their superintendent dated Adelaide, March 11.—I note your remarks under a heading of "Capt. Terrell's reports," that they are vague and general, and want of precision in the details. I, therefore, give you this reply to me on the subject—"I am sorry that my reports have not given the information required. To give the quantity and quality of the ore raised from each winze and stop at Billman is impossible. If we had regular lodes, so that we could drive and sink, and had tributaries at work to take care of their own ore, it would be different; but there is nothing regular at our mine. All the attic and ore are mixed out together, and it is a rush for the kibble from early till late, and to attempt to make quality of the ore in each place would be in effect to stop the works. I do not think there is a mine in the world where—except in general results—it could be so difficult to get at quantity and quality as this. As for the ore that was left by Capt. Anthony, and which is still in reserve, that will never be smelted until we have water and stamps, as it will not pay to hand-dress at the present price."—Smelting: By the returns forwarded this mail you will see there is no alteration of moment in the workings of this department, the copper made for January being 42 tons, from 375 tons of ore, and the slag being 100 tons. The quality of the metal and slags with a richer ore and one furnace less, and will report to you in a few days. Captain Terrell reports, under date Feb. 21—"Billman Mine: No. 1 Winze: There are two branches in this place, the one about 18 in. wide, and the other from 10 in. to 1 ft. The ore could be dressed up to about 32 per cent.—No. 2 Winze: The lode has not been so good as last month. At present we are sinking, and the lode is improving.—No. 3 Winze: The lode in the bottom is much richer, being about 3 ft. wide, of ore about 20 per cent. The lode in the winze is about 1 ft. wide, and about 10 per cent. The lode in the top is about 1 ft. wide, and is good dredgework. Ore raised to Feb. 21, 252 tons; copper, 10,000 lbs., and 3 cwt. The small returns are owing to the stops being poor, and we have had to use more third-class ore. The lodes in Nos. 1, 2, and 3 winzes are still looking very well, but we must begin to sink now to make other stopes. The mine is looking more promising than it did two years ago, but we want a few thousands to stand by until we get down and make regular stopes."

sales we have both in silver and copper, it is almost impossible for us to fail to pay handsome and very early dividends. I say most emphatically that, save

PORT PHILLIP AND COLONIAL (Gold).—K. H. Bland, Feb. 24: Quartz crushed, four weeks ending Feb. 2, 4366 tons; pyrites treated, 25 tons; total gold obtained, 923 ozs. 12 dwts.; yield per ton, 4 dwts. 5½ grs. Receipts, 2558½ lbs. d. m. concentrates, including 1007 lbs. d. m. paid on account of firewood, 1000 lbs. d. m. concentrates, 4394½ lb. d. m. 1385½ lbs. 10d. m. added to the loss of last month, 1032½ lbs. 9d., will make a total of 2418½ lbs. 7d. to the debit of the two companies. Quartz crushed, two weeks ending Feb. 16, 2148 tons; total gold obtained, 414 ozs. 6 dwts., equal to 3 dwts. 20½ grs. per ton. The Chairman has received from Mr. Bland, at Clunes, the following telegram, dated Galle, April 18:—"Yield continues low. Struck good quartz, Old Man Reef shaft, deep level."

Tamar House, near Tatslock, April 21.

ENGLISH AND AUSTRALIAN (Copper).—The quantity of coal at Port Adelaide on March 2 was 600 tons. There were three furnaces at work at Port Adelaide, and one refinery. The extension of the wharf was progressing very satisfactorily; all the piles were screwed down, and the deck was being laid. The erection of the smelting works at Newcastle was being proceeded with rapidly. Since last advices about 136 tons of copper had been shipped.

Tamar House, near Tavistock, April 21.

AUSTRALIAN UNITED (Gold).—The directors have advices from Mr. Kitto, Feb. 28: Central Mine:—"It gives me greater pleasure than I can express to be able to report of our great success at this mine. I will merely give you a few facts and leave you to judge for yourselves. Three weeks since, after passing through the terrible winter, the mine was in a very dry and arid condition, a coarse wash was struck and a little gold found. At one time felt that which you can more easily appreciate than I describe. Two days after another quicksand was reported. Luckily this was only a crab-hole, underneath which the auriferous bed of the ancient stream was found, giving from off the bottom of the shaft, the best of the pure and purified precious metal 234 ozs., of which no share is lost in Melbourne. The fact is, that it was unexpected, that if the ground were locally held, the stock of the Australian United Gold Mining company would have been worth at least four times its par value ere this. Our success is assured. In order to give you an idea of the value of the discovery at the Central, I enclose a letter from an old friend at Ballarat. Our prospects are at least equal to the best." Mr. Thorburn speaks of in his letter. "I am glad to will to give you the look of the Central Mine, of the Central Mine, Mr. Kitto writes:—"The yield of gold from the batteries during the past month has been 111 ozs. 10 dwts., retorted. Quartz treated 729 tons. Although the ground to the north at the 200 feet level has been easier than towards the south, it contains very little quartz, but deeming it advisable to crush it in the hope of meeting rich patches, the slates are so mixed that the yield has been proportionately small. It is very happy to state that the ore has been in vein, since at an apparently fresh spot of stone is dipping from the south of the level towards the north, which Capt. Williams describes as likely to be of average size. Not more than 200 tons was raised southerly, which must have

CENTRAL MINE—Captains J. H. Holman, and Michael Stephens, Feb. 25. "It is with much pleasure we have the honour to congratulate you on the success of the bottoming of this shaft, and on the very handsome yield taken therefrom—2 ozs. 5 dwts. of gold; and we are of opinion that there will be 5 dwts. of gold more when the dirt is all washed up. The shaft was bottomed at a depth of 224 ft. from the surface, and is now 230 ft. deep. It will take about two months before we shall be able to open out, as we have to do some 25 ft. more of sinking for the well, pit, and溜槽, and the slipping at the rate of 5 in. to 6 in. per day, and the price of gold is that low."

DUKE OF CORNWALL MINE.—Captain Williams, Feb. 10, 1892. I began today on a report of the mine for the past month. —Daukes's Shaft, 200 feet level, north drive, 88 feet from the cross-cut: We have driven 29 feet 6 inches during the past month. A day or two after I sent my last report we met with a slide, which greatly disturbed the lode. I am glad to state that there is every indication of our again having the lode of average size in a few days. In the bottom of the drive we have a lode of average size, and dipping fast towards the bottom. —South Drive: We have driven 12 feet since last report. The men began taking from the drive to stop the back of the lode. In the first part of the month, we shall resume driving in a few days. —South Stopes: I am glad to say that these stops are looking very well. —North Stopes: These stops have not been looking so well on the average for the past month as they did the last, but a slight change has taken place for the better during the last day or two. —Bear's Shaft, east and west of air-cut: We are obliged to suspend work on these shafts for the present, owing to the late sultry weather. All other work going on favourably.

The letter of Mr. Torburn to Mr. Kitto, dated Ballarat, Feb. 23 is as follows:—
 "The celebrated Newington Company bottomed and obtained an ounce of gold from a shaft 9 ft. 6 in. by 3 ft. 3 in., and sent 2000 shares up to 80*l.* each. The Park Company gets an average of 500 ozs. per week, and pays a dividend of 8*s.* per month on 12,800 shares, and the dirt so obtained—about 3600 tons per week—costs about 2000 *l.* per ton, or 2*½* d*en.* of gold.—The same company is getting about 6000 ozs. per week, and the dirt is going in the gutter, and will now pay about 10*s.* per month dividend on 12,800 shares. The proprietor in a mine where the dirt does not average more than 11 grs. per truck, or 6 dwts. 9 grs. per ton, and this pays expenses for 112 men employed. We, however, are driving into deeper ground, and expect better returns. The Park Company employ 400 men, and their surface works are enormously expensive, owing chiefly to the cost of raising the water. The tailings are removed at a cost of something like 8*0* *l.* to 8*0* *l.* per ton, if you have a good wash, and put up good machinery, you really ought to get 1000 ozs. per week. The Park Company washes about 8000 trucks per week (say, three trucks to a ton), and I think they get something like 40 *l.* ozs. per week, and pay about 54,000*l.* per year in dividends. Of course, I do not anticipate that you will get 1000 ozs. of gold per

"Trek until your mine is well opened—say a Year, for instance," *The Melbourne Argus*, of Feb. 28, says. "Payable gold has been found in the Central Mine at a depth of 230 feet, or 270 ft. from the surface, or 270 ft. from the level of the plain. This discovery is highly gratifying in many ways. In the first place, it demonstrates the existence of a deep lead in the Kyren and Malmsbury districts, where the area of the basaltic formation is quite as extensive as at Ballarat. Quite a new field is, therefore, opened up. Beyond this, however, it is satisfactory to all concerned, seeing that the Central Mine is the property of an English Company, the Australian United Gold Mining Company (Limited). They have two mines—the Duke of Cornwall, at Fryersdown, and the Central, at Ballarat. The latter is a very large and a very profitable mine, in which gold is now struck. We have seen the gold—need we be shaken from the bottom of the shaft alone. When it is remembered that the Newington Company, at Ballarat, obtained 1 oz. from a shaft of precisely the

same size, and that the shares in that company rose at once to the value of 160,000l., our English readers, especially those holding shares in the Australian United Gold Mining Company, cannot but be pleased at their prospects. The average gold per load at the Central is nearly 1 oz. Mines at Ballarat are paying expenses with a yield of 1 dwt. 9 grs., or about 1-14th of this yield.

ANGLO-AUSTRALIAN (Gold).—Mr. Kitto forwards the following report on the works from Capt. Ralbeck, Feb. 28:—By your request, I have the honour to report upon the different workings of the Sir Roderick Murchison Mine. The shafts and the reservoir are completed according to instructions given by you. The contractors of No. 1 shaft have sunk 66 feet, and secured 30 feet with timber, put in according to specifications. At 49 feet intersected a leader of quartz 1 foot thick, dipping east and north. At 58 feet a leader 1 foot thick dipping east—promising looking quartz, slate to the west. The contractors of No. 2 shaft sunk 60 feet, and secured same with timber, as required by contract. Operations are suspended for the present at this shaft on account of too much water struck quartz at bottom of shaft. I have commenced to take out the earthwork for the foundation of engine-house, &c., and will be finished in about eight days. I have also, as you ordered, opened a quarry convenient to the engine-house, and am pleased to report that you will have good stone for the buildings.

SCOTTISH AUSTRALIAN.—The directors have advices from Sydney and Lambton Colliery to Feb. 25. The sales of coal for the month of January amounted to 11,053 tons.

YORKE PENINSULA.—The directors have advices from the committee of inspection at Adelaide, Feb. 25, with reports from the Kurilla Mine to the 28. The following are extracts from Capt. Anthony's reports:—"Hall's engine has been sunk during the past month 1 fathom 1 foot 3 in., making a total depth from the surface of 6 fathoms; the present price for this is 50s. per fm.; the lode is 6 feet wide, and well defined by walls. On the 25th inst. a blast in the bottom of the shaft broke out a hundredweight of solid yellow ore of 30 per cent., the best yet seen since the surface was passed through. This shows that the lode is improving in depth. . . . I am still driving south on the branch at the 25 level, east of Hall's shaft. Very little change has taken place during the further driving 1 fm. 2 feet 3 in. The branch continues to produce rich stones of ore, and to yield water, but I am yet unable to determine its real character, whether it is only cross branch or whether it leads to another lode parallel to the one Hall's shaft is sunk on. . . . The lode in the 25 level going towards Deebie's shaft is worth 30s. per fathom. I am now putting a rise from this level to meet Deebie's shaft, so that driving is suspended for the present. This 'find' shows that the ore discovered at Deebie's holds good in depth. Deebie's shaft is 17 fathoms 2 feet deep. I am sinking this shaft with the object of hoisting to the 25, rising at the same time from the said level to meet it, as before stated, the present price for this is 50s. per fm.; the lode is 6 feet wide, and well defined by walls. The water, which is now drained by means of a horse-wheel, will be conveyed to Hall's shaft through the 25, and pumped to the surface by the engine, effecting a saving of 10s. per week. . . . I hope by May to begin again to raise ore enough to pay the whole cost of the mine. On the 8th inst. I sold from Deebie's 80 tons 5 cwt. 3 grs. ore, of 15 1/2 per cent., realising net 576l. 12s. 3d. I have now on hand (including tributaries' ore), and ready for bagging, 45 tons of ore of low quality. The engine and pitwork are going on satisfactorily."

FOREIGN MINES.

ST. JOHN DEL REY.—Morro Velho, March 17: Morro Velho produce for February, 7763 oits., from 3455 tons ore; yield, 2-21/2 oits. per ton; cost, 3980l.; loss, 977l. Morro Velho produce 11 days of March, 2675 oits.; yield, 1-81/4 oits. per ton. Gaia produce for February, 390 oits., from 338 tons ore; yield, 1-15/16 oits. per ton, cost, 388l.; loss, 290l. Gaia produce 11 days of March, 127 oits.; yield, 798 oits. per ton. Mr. Gordon states that the produce from Morro Velho is as nearly as possible about the same standard yield and daily produce as extracted in the first and second divisions of February. The place in the mines now being worked do not appear capable of giving a better gold return. Other arrangements will be tried. The health of the establishment is pretty good at present. During February prices generally have been favourable, and then provisions have cost them 1 conto of reis less than during previous months. The way at the new shafts is large, owing to the quantity of timber used, and much labour having been expended, not only for the shafts properly speaking, but for some heavy surface work now pressing forwards for future use in sinking and working the mines when re-opened. Further reduction in their expenditure must now be made, though it is the most difficult to effect this without almost incurring future prejudice to the company.

DON PEDRO.—Mr. F. S. Symons reports for February:—Produce, 9041 oits., at 8s. 6d. per oit., 3842l.; cost, 3192l.; profit, 650l. The cost is heavy, owing to the whole amount paid for timber having been charged—855l.; expense of bringing party from Rio, 73l.; iron shaft for the horse-engine, 37l. A limited supply from the bottom stops on Canoa, and general body excavated poorer than usual, together with a short month, have occasioned a considerable drop in the produce. The lode in Alice's west, though promising, and giving at times fair strike work, has, on the whole, been poor; no line has yet been encountered. When this section is ventilated the works will be pushed on with greater vigour and a larger force. In the cross-cut south from Alice's west a branch of Jacotinga, slightly auriferous, has been intersected, and will be worked on in March. The stops in Canoa have yielded but a small supply of ore, owing to water. On the general body of lode excavated has been less auriferous than usual. Sinking's shaft on fairly at Vivian's shaft, and we are still auriferous ground in the bottom. First division of March—Extract from letter dated March 17: Produce weighed to date 1655 oits. I am sorry to report so poor a return; no box-work, and the general body of the lode excavated being very poor, are the reasons. The line in No. 6 is defined, but not rich enough for box-work. The lode in Alice's and the cross-cut south presents most favourable indications, though at present time poor. No line has been struck, but, as in all auriferous Jacotinga, there are lines either in the lode or contiguous, we have faith that this new discovery will not be an exception to the rule. For a long time we worked on No. 6 before taking out box-work. A very little lode has been taken from Canoa, in underlie lode, the water affecting the supply. Treloar's level and the middle adit are progressing, as well as sinking Vivian's shaft. The work at the horse-engine is proving trying for the animals; it is under consideration to erect a water-wheel to do away with animal labour. We have still auriferous ground in the bottom of the shaft. A large force is engaged on work for permanent pumping machinery.

GENERAL BRAZILIAN.—Capt. Thos. Treloar reports for February: I submit, with pleasure, the monthly documents for February. The party of miners from England have arrived, the native force is steadily increasing, and the weather has been unusually fine; and, owing to these circumstances, the requisite impulse has been given to our operations. The adits for draining the old mines have been taken vigorously in hand, and explorations commenced; but whether gold will be struck in new ground to-day or to-morrow, or months hence, I cannot say, but that rich shoots of ore will be discovered in new ground no one here doubts. Extract from letter, dated March 16:—I am pleased to say that our operations generally proceed very satisfactorily. The surface works are proceeding apace, the health of the establishment good, and all hands are working cheerfully, and with a will as satisfactory to me as it is beneficial to the company.

ANGLO-BRAZILIAN.—Mr. F. S. Symons reports for February:—Produce, 3225 oits., at 9s., 1451l.; cost, 1425l.; profit, 26l. Works have been carried on with the usual regularity, produce per working day is in excess of January, the profit, though small, is better, and the standard shows a trifling improvement. There is an improvement in the stone from the deep adit. At Foster's west stop, nearest Fundao, the lode has become disordered, but at Dawson's there is larger. At Hayman's shaft we have a lode which bids fair to open out to large dimensions. The repairs required at Martin's incline were more extensive than at first thought. In March they will be completed, and we shall have means of hauling an increased quantity of ore. First Division of March—Extract from letter, dated March 17:—"Works are proceeding steadily, no change of importance to notice in the lode. The force is improving, and the sanitary state of the establishment is good."

ROSSA GRANDE.—Mr. Ernest Hilleke reports for February:—"The gold return for the month amounts to 2358 octavas, derived from 160 tons of ore, averaging 14-74 octavas per ton. Mina de Serra: The features of the lode at the various places in progress are not the same as when last reported on, excepting in the 60 east; the size of the lode here has increased favourably, and the stopping ground is left below the level. It is highly encouraging to observe the continual amelioration in the auriferous quality of this lode; the average percentage of the stone treated during the month shows the gratifying result of 14-74 octavas per ton. Cachoeira Mine: In re-opening and securing the old adit we met, about 28 fathoms in from surface, a large body of lode from 18 to 20 ft. wide; it is composed chiefly of white quartz, brown oxide of iron, and pyrites. Samples taken from this lode will show, more or less, some gold; and, judging from these, it may produce from 4 to 5 octavas per ton, but an estimate arrived from sampling only sometimes is very deceptive, therefore to ascertain its real value we have commenced making preparations for conveying the ore to the stamping-mill, so that it may receive a fair trial. Gongoo Soco: I have nothing of importance to communicate regarding the Jacotinga explorations; the party performed has been satisfactory, but nothing new has been discovered. First Division of March—Extract from a letter dated March 18:—"Little or nothing occurred during the month. The lode at Mina da Serra has undergone no change, and maintains its pleasing appearance. A few days ago we commenced treating the stone of the lode recently discovered at Cachoeira Mine. It will require the whole of the month before we can ascertain its real value. So far the skins at the stamping-mill are looking poor." In a supplemental report it is stated by Capt. Thomas Treloar that, on the whole, the appearances are becoming more and more hopeful, and once the question of force settled there is good reason to believe that the company will do well."

ANGLO-ARGENTINE.—Capt. J. Vivian, Guallian, Feb. 28: In the cross-cut driven east in the base of the hill the main lode is intersected, and is cut into about 2 ft., the eastern or west wall, is not yet reached; it is a very strong, fine-looking lode, and full of mineral. As soon as it is driven through, so as to know its width and general character, I will write again, and send you samples of the ore. Capt. Vivian further remarks, with reference to the South Mines Captain, that the engine-shaft has been sunk from surface 27 fathoms. At Manager and North Mine Coronel the works are progressing satisfactorily, as are also all the surface works.

ECLIPSE (Gold).—The directors have advices from Capt. Barrett to March 30:—"I am happy to say the Eclipse Mine is transferred, paid for, the deed is in my hands, and the Eclipse Gold Mining Company (Limited) have now possession of a very extensive and a very rich gold mining property. One-half of our staff will leave here on April 1, and myself and the remainder of the party on the Monday following, and hope to arrive at Eclipse, Independence, Owen's River, on the 12th. I will then, on arrival, get our new deed registered or recorded, and immediately commence mining operations."

EXCHEQUER (Gold and Silver).—Capt. Chalmers, March 21: During the week ending March 19, 18 ft. of air-shaft, 5 ft. of winze sunk, and 13 ft. of south drift run towards the shoot of metal we had above, with a view to send a few more tons to Reno, to compensate for the inevitable delay which has taken place in our first shipment of bullion, in consequence of the repairs now being made at the mill. Enclosed I send you Wells Fargo's receipt for box containing 105 lbs. of ore specimens forwarded from Reno on the 14th inst. The teamster taking the mill, and repairs, informs me that the repairs now going on there will not be completed for a fortnight yet, which is very provoking.

(For remainder of Foreign Mines see to-day's Journal.)

The Royal School of Mines, Jermyn Street.

MR. WARINGTON SMYTH'S LECTURES.

[FROM NOTES BY OUR OWN REPORTER.]

LECTURE XXXVIII.—Continuing the subject of laying out the workings for stratified deposits, Mr. SMYTH said:—"We have arrived as far as the consideration of the modes by which in the simplest and most ordinary state of things the shaft is sunk to the bottom of a piece of ground to be worked, from which the levels are driven out. The driving of the levels will differ according to the scale on which the work is to be carried out, although the principle which guides it is the same. The first point aimed at is to push forward exploratory drifts, by which a considerable quantity of mineral is secured, but their main object is to see what is the condition and nature of the mineral, and to drain the ground so as to enable the men to work it. The question then to be determined is the direction in which these levels are to go; and, as a rule, they ought to be approximately on the line of strike, or, in other words, at right angles to the dip. If a single level only were to be driven, difficulties would arise from the water running along, and also as to ventilation. It is, therefore, the universal practice to drive the levels in pairs, as near to each other as possible. One of these is called the water level, because in it the water remains almost stagnant. A trifling inclination is, however, necessary, both on account of the drainage and to facilitate the locomotion of the full wagons, which are brought along it. When the level is thus to be employed as a roadway the usual gradients are from 1 in 160 to 1 in 200, or 3-16ths of an inch in a yard. The two levels are independent of each other (except so far as they are connected with each other by cross-cuts put in for purposes of ventilation), and they are carried usually right and left of the shaft along the boundary of the piece to be worked. In ground where there is no indication of any considerable extent there are no difficulties, and if we inspect the older workings we shall find that the levels are often extremely crooked, giving rise to a great deal of wear and tear in all the apparatus used for drawing. The seams themselves are subject to undulations of various kinds, and it may be necessary to cut through some of the upper or lower ground, so as to avoid turnings and curves, and to make the level a good road for haulage. It was the old custom in cases of this kind when in cutting a level they came to the main level, to go round an obstacle, and resume the line again in the seam beyond. Of course, they could not go lower on account of water, but they were in this way continually getting turns, which could not be otherwise than extremely inconvenient. It was, however, the practice wherever they met with a throw to turn the level, and hence it is that the old levels, if accurately planned, present to the eye irregularities, very different, indeed, to what might be expected in works regularly laid out. In the North of England, if the works be on anything like a great scale, irregularities in the ground or seam are wholly disregarded, and the level or road is carried straight through even very hard masses of stone if they come in the way. Thus, in modern times in laying out a large mine, with a view to economy in the working, we must neglect all these small interferences, and cut the levels straight through the ground, even although it may entail a greater expense of time and money, in order that the wagons may have a straight course, and the least possible wear and tear. I may mention en passant these faults that in a large colliery it is unsafe to judge of its probable productiveness by plans unless they are laid down on an exactly minute scale. A general plan sometimes includes amongst the good coal pieces which are not worth working at all. Geologists are sometimes given to multiplying the length of a piece of ground by its breadth and the thickness of the coal, and thus obtaining a sum total of tons to represent the contents of the area, which, however, when it comes to be worked out may be reduced by half or two-thirds, in consequence of the faulty nature of the ground, to say nothing of the waste in working. The next question will be whether the area shall be worked outwards or backwards. That is, shall some of the coal near the shaft be at once worked away, or is it better to drive to the boundary and work back? A good deal of discussion has been raised on this point, and in some cases it may be desirable to carry on to the boundary before commencing to get the mineral. One reason is that by going to the boundary at once you leave all the spaces from which the coal has been got, and do not have to return to them again, whereas by the other plan dangerous areas of goaf, at no great distance from the shafts, are left, in which explosive gases accumulate, and which are a constant source of peril, from the open lights of the miners, and the traffic to and from the shafts. On the other hand, the danger arises in many ways, as soon as the works begin to be opened out in wide spaces, the roof is liable to crack and come down, and everything being on the move, the country is greatly affected thereby, and gas is given out more or less freely, establishing dangerous magazines of explosive atmosphere, which lurk, as it were, near where the men have to pass, and, therefore, as a general rule it is a system very much to be deprecated, as it is only where a perfect isolation can be attained that such accumulations of gas ought to be tolerated. On the other hand, there are few companies which are capable enough to allow them to drive out at the first to the boundary. It may be that the cost of sinking the pit has amounted to 30,000l., and the shareholders naturally are desirous to get a return for their outlay as early a period as possible. Most engineers, therefore, find it necessary when the levels are driven to a moderate distance to begin to work.

The methods of working coal are several. Those most diverse in principle are the pillar and post and stall work, which prevails in the North of England, and the long wall system. The other modes may be traced to one or both of these two. The first depends on the principle of open narrow galleries, from which the coal is got, leaving pillars of sufficient size to prevent any amount of rock from falling down, and everything being on the move, the country is greatly affected thereby, and gas is given out more or less freely, establishing dangerous magazines of explosive atmosphere, which lurk, as it were, near where the men have to pass, and, therefore, as a general rule it is a system very much to be deprecated, as it is only where a perfect isolation can be attained that such accumulations of gas ought to be tolerated. On the other hand, there are few companies which are capable enough to allow them to drive out at the first to the boundary. It may be that the cost of sinking the pit has amounted to 30,000l., and the shareholders naturally are desirous to get a return for their outlay as early a period as possible. Most engineers, therefore, find it necessary when the levels are driven to a moderate distance to begin to work.

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LECTURE XXXIX.—I have been speaking up to the present time of deposits of coal and of ironstone of moderate dimensions. I have shown you that in the earlier times the space taken up by the pillars was small, and the object was to secure at first the larger part, but that in modern workings the quantity got out is smaller at first, the pillars left of larger size, and the pillars worked out afterwards, and the roof let down in the state of what is called "goaf." The nature of this goaf is a matter which always ought to be taken into consideration in the working out of a piece of ground. Thus, when the

working is by pillar and bord, if the pillars are of sufficient size, they may stand for many years without damage from "thrust" from above or "creep" from below. But there are dimensions which cannot be exceeded in the openings without evil results. Thus, if the bords are driven too wide the roof must break in; if, on the other hand, the pillars are made too small it is evident the pressure from above will crush the pillars into fragments. The great thing, then, is to decide upon the size of the pillars best calculated to allow the coal to be got out afterwards in a good state; and, when that is decided upon, to remove the pillars upon some plan which will not endanger the roadways or the shafts, but gradually allow the whole of the strata above to fall in, leaving the goaf, or gof, inaccessible to the miners. It is, unfortunately, accessible to the carbonic and hydrogen gases, which, being lighter than atmospheric air, get into these spaces, which are made by the fall of the roof, and the pillars are removed the one after the other. This involves the question, and they are of great importance, how far this may be done from the surface without affecting it; and, then, how far the size of the pillars may be limited, and how far they may be ultimately removed. The bords are usually 4 or 5 yards in width, and the headways between them are commonly 2 or 3 yards in width; but the pillars are 80 ft., or 40 ft., or 60 ft., leaving thereby enormous masses of coal. On this system it may be that one-third only of the coal is intended to be got in the first instance, and two-thirds left as pillars, and it is managed that the coal forming those pillars shall not be injured until it is required to get them. Then comes another question—is it advisable to go over the whole of the ground, and lay it out all in a state of pillars, before the latter are worked? If the strata be a large one, there is the chance of these large vacant spaces will occasion great expense in the maintenance of the airways, so as to prevent the gas from accumulating, and constant and unremitting inspection and care. Thus, many engineers prefer taking down the pillars after a certain area of the coal has been opened, and the bords and headways made. No doubt the best rule is to take away the whole, but it is a system which requires experience and proper laying out of the colliery, at first with a view to the work, and there are special reasons in its favour with reference to ventilation, as the men generally work with open lights, but there are few cases in pillar working in which the ground is set moving in which gas is not dislodged, and considerable dangers ensue. As the operations advance, however, care must be taken that the open lights are not employed where, by a fall of roof, the gas may be thrown back, and an explosion result from the use of open lights. Details in matters of this kind will be found in great and interesting variety in the numerous papers of examination which have been placed before viewers in the North of England by successful Parliamentary Commissioners and Royal Commissioners, and answered by such men as Buddie, George Stephenson, Nicolas Wood, George Elliott, Foster, &c., between the years 1848 and 1853.

There is another point connected with these pillar workings, arising out of the fact that successive seams of coal within a few yards or fathoms of each other have to be won. Suppose that at the depth of 100 yards we have a seam, then at 150 yards another, then at 180 yards a third, and at 200 yards a fourth; becomes a question which of those seams should be worked first. It has been held that it is best to go to the bottom first, and work away from there, so that the gas from the bottom seam is displaced by such great masses of coal being formed, this is a most complicated question, inasmuch as it has been found that working for one seam almost invariably affects the others, whether above or below it. Mr. George Elliott wrote a paper on this subject some years ago in the Transactions of the North of England Institute of Mining Engineers, containing some curious facts, which occurred at Monkwearmouth, and proved that it was not a question to be settled at once. Amongst the results of his experiments were these:—Suppose the lower seam was worked first, it was found that when the pillars came to be got a movement would be produced which would effect considerable change in the seams above, making them to be worked, but so crushed as to give a larger amount of slack. In this case the Maundin seam, 6 ft. thick, is 265 fms. from the surface, and the Hutton seam 4 ft. thick, is 285 fms. The two seams were worked simultaneously, the pillars left being 30 yards by 40 yards thick, and the bords 5 yards in breadth, the leaving seven-eighths in the shape of pillars. The pillars being removed over a large area in the upper seam, and a considerable goaf being thus formed, the workmen found when they came to cut away the lower seam beneath this goaf the coal to be much harder, and more expensive to work, but it produced a larger proportion of whole coal. Another change produced by the alteration of the pressure above was that it would not stand to be undercut, but always burst off with a crackling sound. On the whole, it was considered that the advantage gained by the larger proportion of round coal compensated for the extra expense of working.

On the other hand, I have seen cases in which the effect produced has been exactly the reverse. Thus, at the Usworth Colliery the removal of the pillars above had a decidedly pernicious effect upon the seam below. The removal of the pillars opening out large spaces also always materially injures the roadway which it may be necessary to keep up, and which then require constant repairs. When the ground is hard the strata above will hold fast sometimes over a large area, but it must come down at last; and in such cases the fracture of a large roof of this kind almost always led to serious results, in the shape of explosions, from the gases being displaced by such great masses of coal being dislodged. In the lower seam it will be found when the upper one has been worked the roadways may keep good for some distance, and the walls stand well; but if there should be a part in which, from its yielding nature, a quantity of gas had been put in, it will be found that they will be constantly giving way, the roadways will become one mass of slush, and all this will be the simple result of the strata above bending down and forming a sort of basin, in which the water will settle, and then penetrate through to the levels and workings below. It is, therefore, a matter of calculation, if by getting more whole coal the value of "the get" is increased, is the get in the seam, but the inconveniences and changes produced involve an additional expenditure of a per ton, the balance between the two may make all the difference between a paying and a non-paying concern. On the whole, however, it seems to be generally held that when there is considerable pressure it is better to press the upper seam first, and to let the ground down, it being found practically that the ground will then come to a state of rest, which will admit of the second seam being worked advantageously. I have mentioned some of the advantages arising from this course, but, at the same time, being considered, the balance is decidedly in favour of removing the upper seam first.

In the Lancashire collieries the bord and pillar system is largely employed, but it is in a modified form, in consequence of the steep rise in the dip to the measures are there subject, the latter lying at a considerable angle as compared with the northern collieries, where they are exceedingly flat. In North Staffordshire the pillar system is modified after the same fashion. Series of levels are driven out from the pit bottom, and if the dip is high angle it is modified to work each seam by a cross-cut, or "crut," as it is called. Older levels, called "fig-brows," are then driven in pairs, at from 120 to 140 yards asunder from pair to pair. The angle of inclination is so considerable that the work in the ordinary way could not conveniently be done, and therefore the drifts from which the coal is to be gotten are commonly placed parallel to the main levels. The pillars left are 10 yards wide, and from 30 to 40 yards in length, while the bords are not more than 3 or 4 yards in width. When the coal is removed the pillars they take away pillars No. 1, bit by bit, leaving a narrow wall where necessary; they then take away pillars No. 2, and so on. The pillars are thus taken away alternately, until, starting from the boundary of the one hand, and the old workings on the other, they clear the way to the shaft. This system gives good results, but not all that could be wished for. The tenderness of the coal, however, the inferiority of the roof, and the considerable amount of inclination which have to be dealt with makes it applicable to this district. Wherever the inclination of the beds is considerable the removal of the pillars is a work of great difficulty, and the security of the workings must tax all the ingenuity and energy of the manager and engineer. Another modification of the pillar system is that in which from the coal being very tender and the roof bad the openings are made unusually small, and the pillars comparatively large, but inferior in dimensions to those I have been speaking of. There are old fashioned mines in Anglesey and North Wales where the openings are only 4 ft., and the pillars 4 yards square. In West Wales, where the ground is wet, and liable to inundation, this system was found to lead to difficulties; and they, therefore, make the openings 5 yards, and the pillars of the same size, but if the crossings, or "th' mags," are of the same size the areas at the crossings are too large, and the corners being unsupported are likely to break away, and in any case the corners of the pillars are so small that the greater part of them must be left. In some districts, however, where the coal is stronger than ordinary the pillars are split before they are abandoned. Another modification is found necessary in working the thin coal seams of Yorkshire and certain parts of North Wales.

Pillar working formerly was laid out in regular succession with no more divisions of the area than those produced by the levels from which the bords were opened out, but now the system introduced by Mr. Buddie of dividing the workings into a number of compartments, called panels, separated from each other by a considerable thickness of coal, is generally adopted. If a new colliery were opened on this system each panel, or set of workings, would be connected with the others by certain necessary roadways—that is to say, there would be a single entrance and single exit to each panel. Thus, when an accident occurs in a panel its effects are limited to that district or panel. It has been proposed by legislative enactment the number of workings in each colliery, and in each panel or department of a colliery, but the circumstances connected with the occurrence of coal are so variable that it would be extremely unsafe to fetter the judgment of coal owners and engineers by restrictions which, in the laws of the Medes and Persians, must not be departed from. There is no doubt that in many districts dangerous systems are in vogue which might be replaced by better ones, but it is really an impossibility to lay down any rigid system which will be applicable to all circumstances.

Let us look for an instant at the Yorkshire systems, the operations of which have been attended with so many accidents. The old plan was to run two levels on the strike of the coal, and then at a distance asunder of about 90 yards two of levels are run out at right angles, called bord gates. Between these parallel stalls are driven of such dimensions as are consistent with the roof breaking down at once. The stalls are from 5 to 8 yards in breadth, and the coal is got by making a cut down the bord gate, and taking it off in a series of steps. Under this system the face of working is carried to a great distance along the line, and is a constant source of danger. This system, although great improvements have been made, is still in use. One of these modifications is that adopted in Derbyshire. Road ways are driven out the same as before, and then what are called wickets, from 12 to 24 yards in width, leaving pillars between them of from 8 to 12 yards in thickness. These are often insufficient to resist the pressure enough to preserve the quality of the coal left behind for the returning of the wickets, and it is considered an improvement to make the pillars wider, and to open out thirlings for the escape of the men in case of an accident taking place. In some of the more recent collieries the workings have been laid out as to cross the direction of the coal. [A plan which Mr. Smyth has drawn of workings before its last misfortune.] There were here also large faces of workings in which the men were protected by pack walls, ribs of coal, and roof props, leaving the gas to accumulate, and, therefore, still retaining a source of mischief. It is a plausible system, for having so long a face of coal can be worked with economy, but its disadvantages are not inconsiderable, and there is a great loss of coal occasioned by leaving the ribs on either side of the road ways and bord gates.

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